FIG. 1

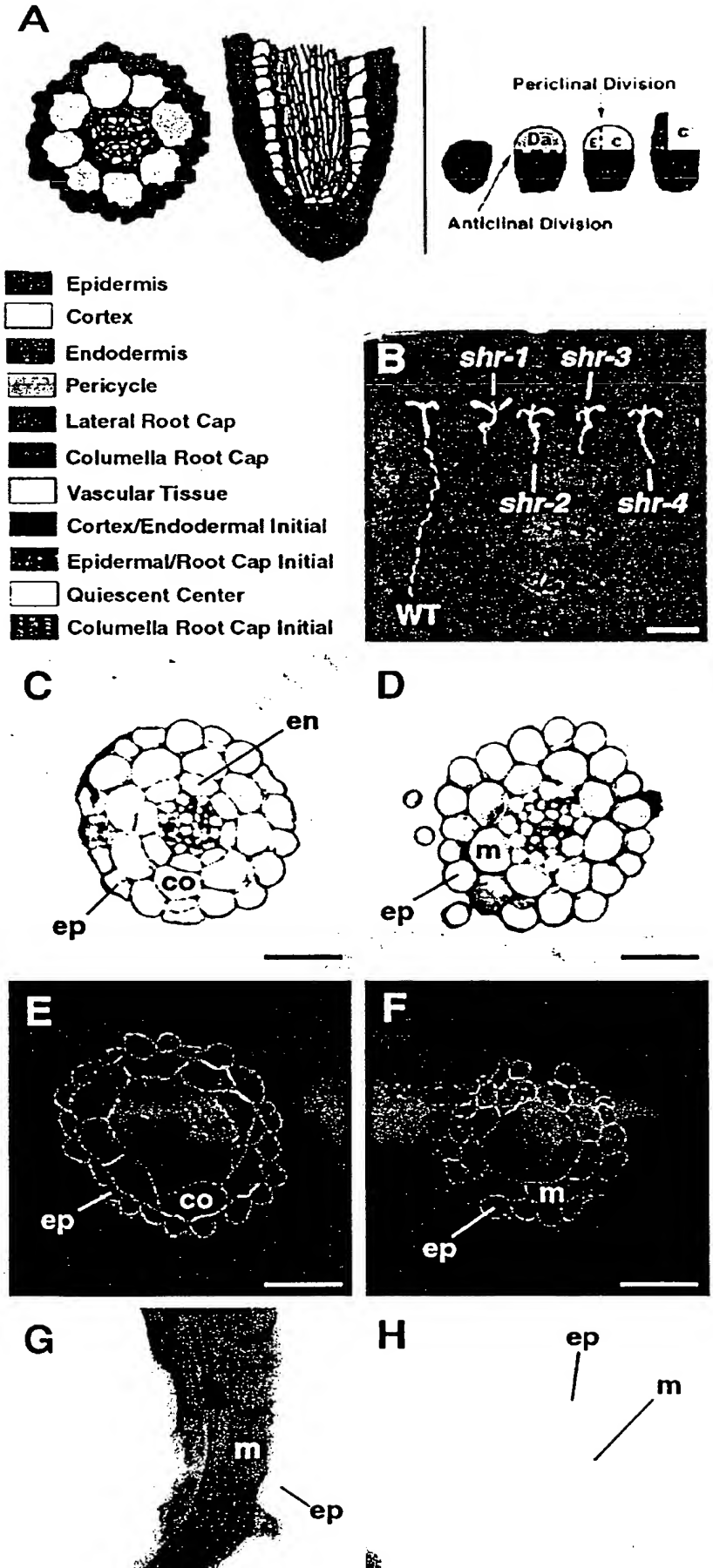
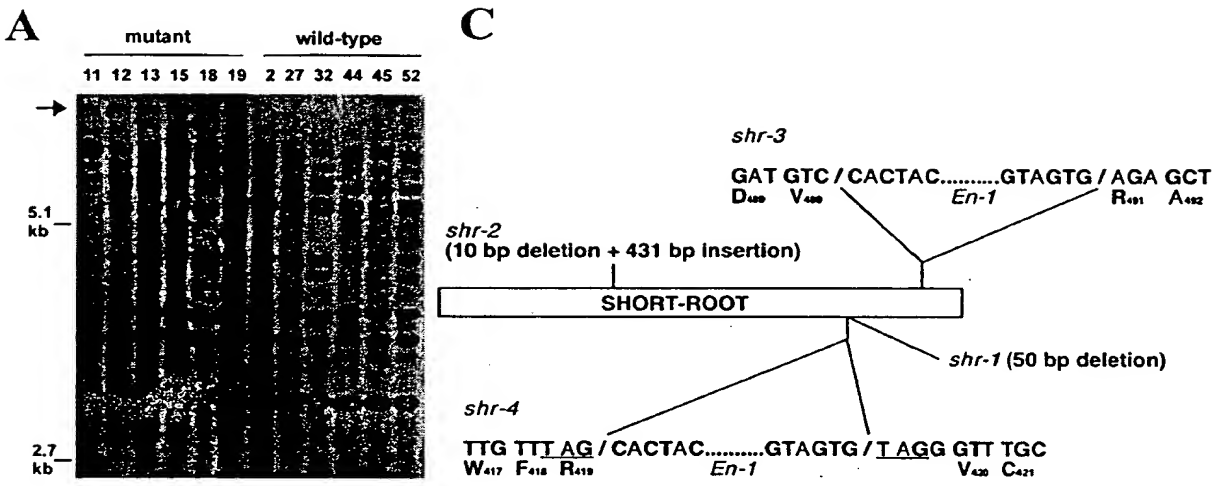

A
Periclinal Division
Anticlinal Division
Epidermis
Cortex
Endodermis
Pericycle
Lateral Root Cap
Columella Root Cap
Vascular Tissue
Cortex/Endodermal Initial
Epidermal/Root Cap Initial
Quiescent Center
Columella Root Cap Initial
B
shr-1
shr-3
shr-2
shr-4
WT
C
en
co
ep
D
m
ep
E
co
ep
F
m
ep
G
m
ep
H
ep
m

FIG. 2



B

```
LS    144  PFIRFTQLTANQAILEAINGNHQAIHIVDFDINHGVQWPPLMQALADRYPA-PTLRITG
GAI   248  PYLKFAHFTANQAILEAFQGK-KRVHVIDFSMSQGLQWPALMQALALRPGGPPVFRLTG
RGA   301  PYLKFAHFTANQAILEAFEGK-KRVHVIDFSMNQGLQWPALMQALALREGGPPTFRLTG
SCR   379  PLVKFSHFTANQAIQEAFEKE-DSVHIIDLDIMQGLQWPGLFHILASRPGGPPHVRLTG
SHR   233  PWATFGHVAANGAILEAVDGE-AKIHIVDISSTFCTQWPTLLEALATRSDDTPHLRLTT
```

FIG. 3

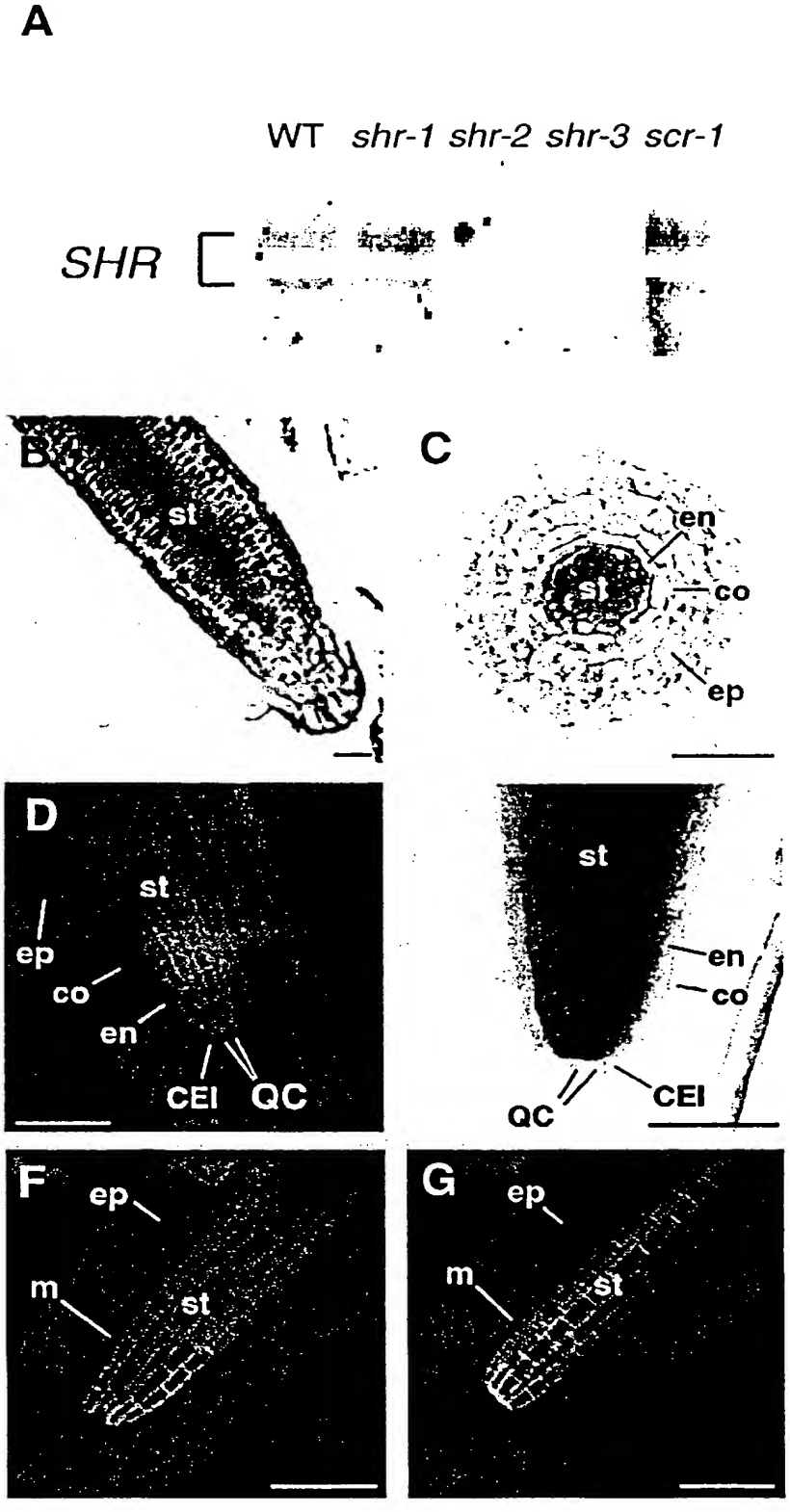

A
WT shr-1 shr-2 shr-3 scr-1
SHR
B
st
C
en
st
co
ep
D
st
ep
co
en
CEI
QC
st
en
co
QC
CEI
F
ep
m
st
G
ep
m
st

FIG. 4

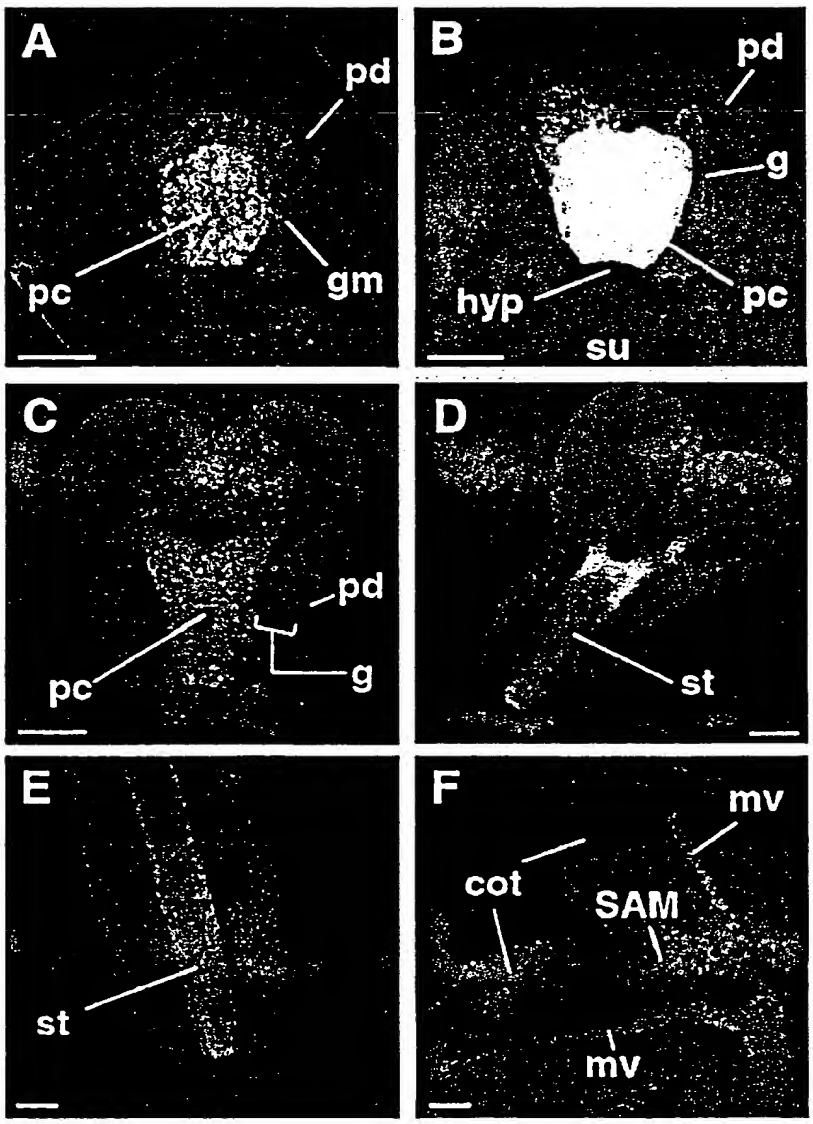


FIG. 5

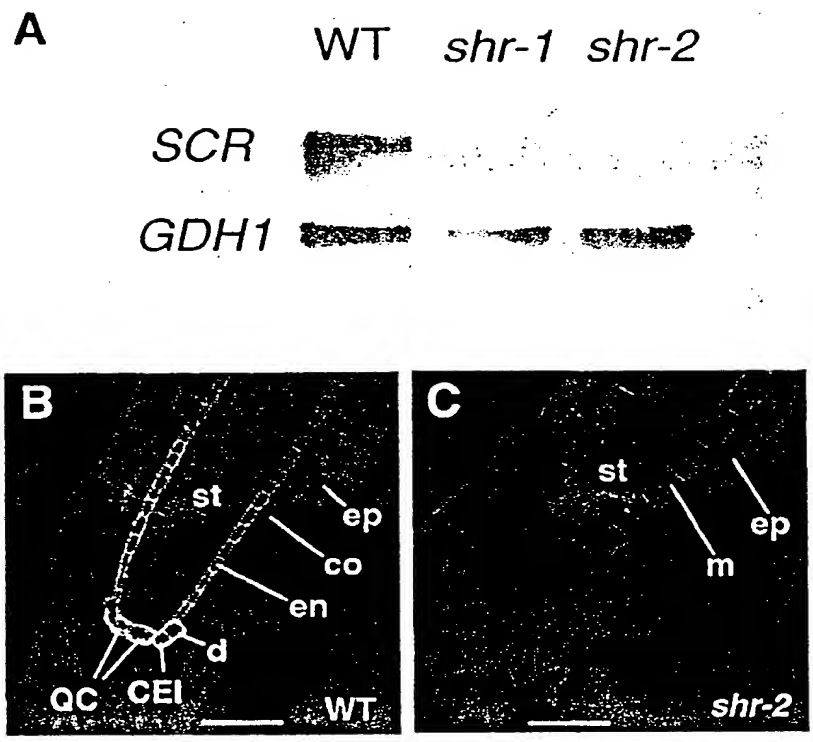


FIG. 6

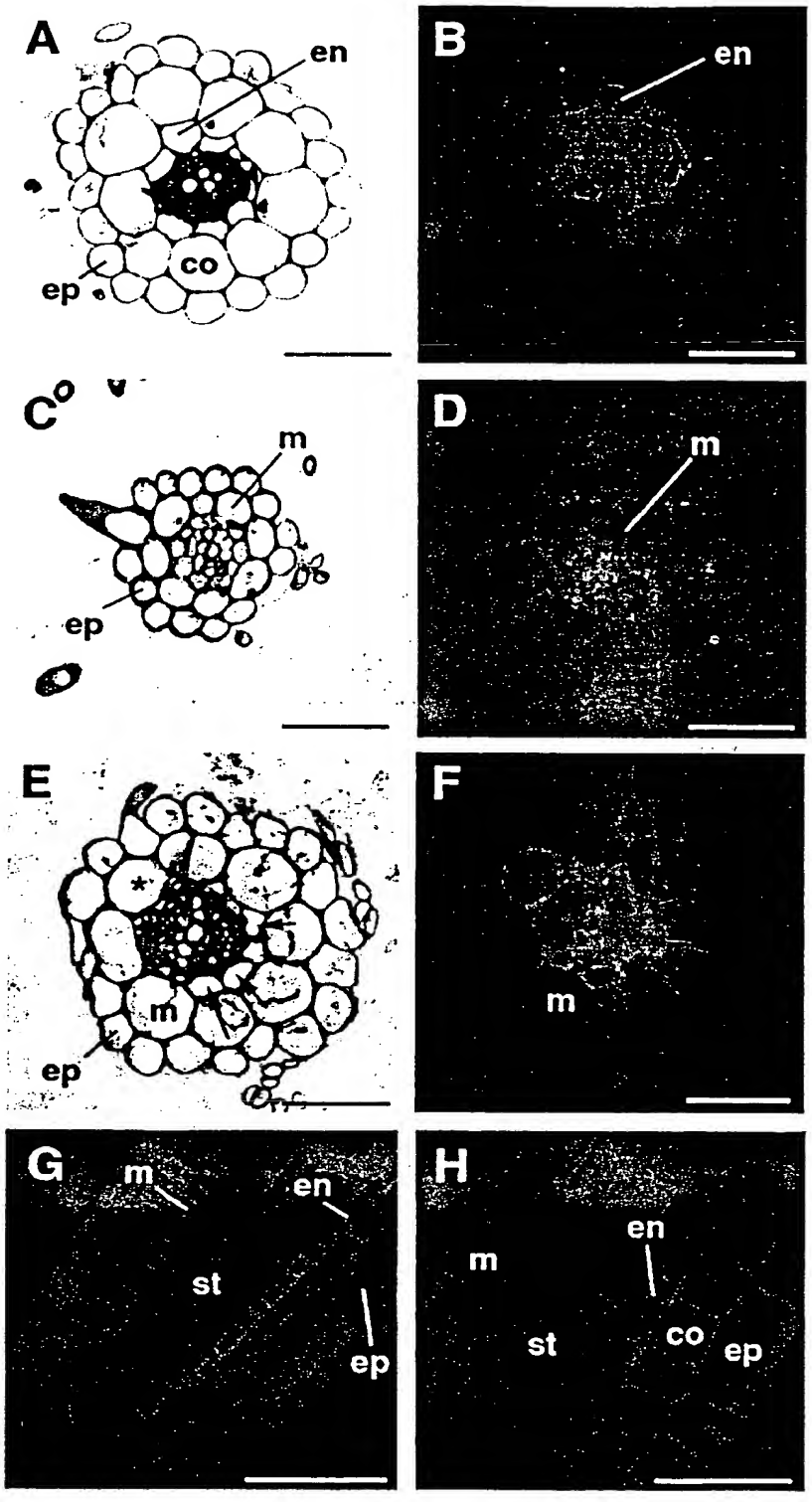


FIG. 7

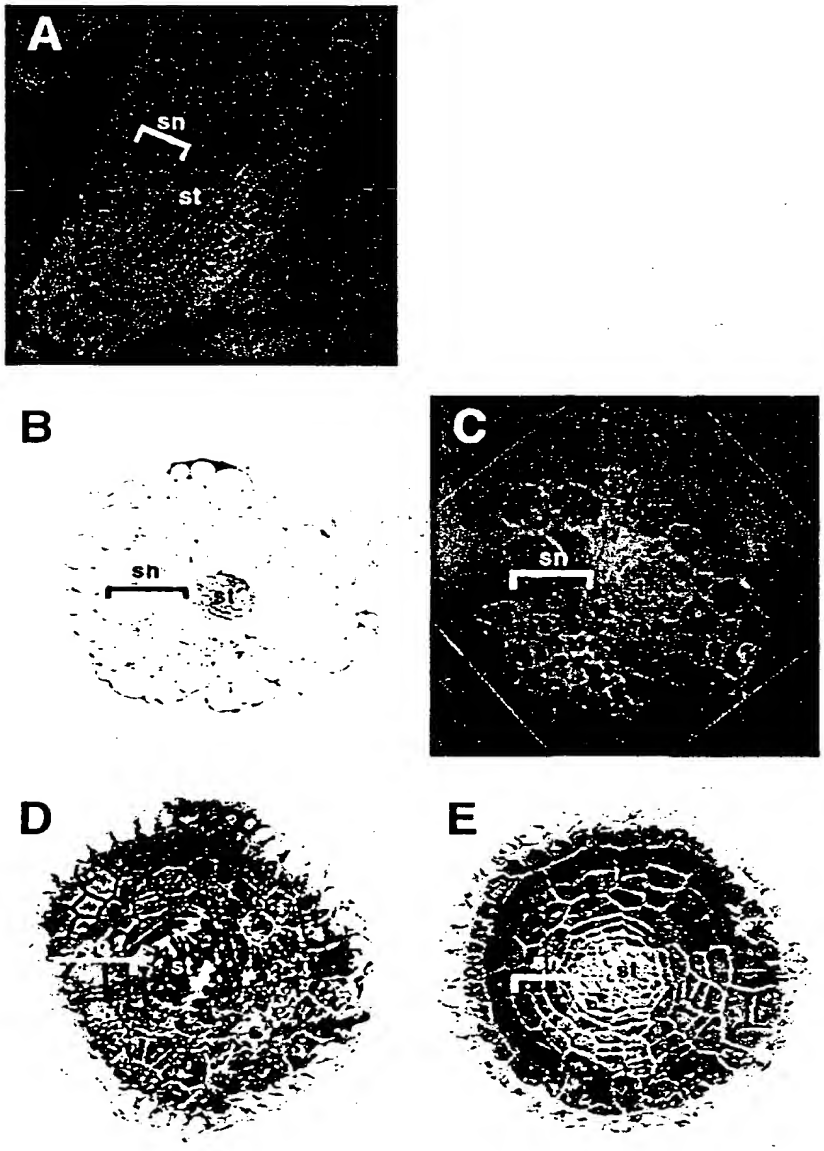


FIG. 8

```
   1 atcgattaag agaaaataga gttttcatgc accagtgttg atagtaacgt agtcgcggaa
  61 tgtctaaaac gattatgagt ttggtgtttt gattggttag aattggtatt agtaggacat
 121 tctaactttt ttgttagtct gttgatttag gatgcgtaaa gagtcttttt attttacacc
 181 agttgagact tgggatcgat agtacttgaa acacttggtt ggtttcatgt atttggccta
 241 tatataaaca aacatcgtaa ttatatacgg attttttcg gaattttacg ccatatctgt
 301 aagtatatat aacatgcatg tcgttttcaa attcatatga tgaacgatcc acgtaagtgc
 361 tactactcct acaatattgc atgagagaga tatgtattta taaattttat tttgaagaag
 421 aaataagagg gaaggttact tgggtggatc gatgtgaaaa caaaagaaga aaaagcgaaa
 481 cccactaagc cattacatga tatcgacctt cttatctttt tcctctttat tttatttttc
 541 tcaggacttt tttctactta atgaaacctc caaactatct aactaataca ctcccatgta
 601 gaataaagaa aattatataa gatattgttg atattttgta actagaaaat atatttgctc
 661 tgtaattttt cgtaagttaa atcaacattt ttcagtagaa acaaatatta ctgcaaaaag
 721 taggatcatt atttttgtcc aaaatctcag ttagctatag ggttgtagta aaaacaaaac
 781 acattcttga tttgccccaa aaaataaaga gagagaagaa tattgttcaa aagtggtctc
 841 ttctctctct aattatgttt tcactaaacc caattagatt caaacagtct acaaagtcca
 901 aaagataaac atgggacaac aattcgatgc aaaaaatcct cttttcatgc tctttttta
 961 ttctctagtc ttttaaatta ctaataaaaa ctcacaaatc caccaaaccc attctctaca
1021 actcaccttc atctagattt acccactccc accgagaaac acaagaaaaa aaatatacat
1081 atataaatat acaagacaac acatgatgct gatgcaatat acacaacaaa gtattaaatc
1141 ttagatattg tgggtctccc tttcttctat tcattttctt attcattaaa aaaaaaaaat
1201 ggatactctc tttagactag tcagtctcca acaacaacaa caatccgata gtatcattac
1261 aaatcaatct tcgttaagca gaacttccac caccactact ggctctccac aaactgctta
1321 tcactacaac tttccacaaa acgacgtcgt cgaagaatgc ttcaactttt tcatggatga
1381 agaagacctt tcctcttctt cttctcacca caaccatcac aaccacaaca atcctaatac
1441 ttactactct cctttcacta ctcccaccca ataccatccc gccacatcat caaccccttc
1501 ctccaccgcc gcagccgcag ctttagcctc gccttactcc tcctccggcc accataatga
1561 cccttccgcg ttctccatac ctcaaactcc tccgtccttc gacttctcag ccaatgccaa
1621 gtgggcagac tcggtccttc ttgaagcggc acgtgccttc tccgacaaag acactgcacg
1681 tgcgcaacaa atcctatgga cgctcaacga gctctcttct ccgtacggag acaccgagca
1741 aaaactggct tcttacttcc tccaagctct cttcaaccgc atgaccggtt caggcgaacg
1801 atgctaccga accatggtaa cagctgcagc cacagagaag acttgctcct tcgagtcaac
1861 gcgaaaaact gtactaaagt tccaagaagt tagcccctgg gccacgtttg gacacgtggc
1921 ggcaaacgga gcaatcttgg aagcagtaga cggagaggca aagatccaca tcgttgacat
1981 aagctccacg ttttgcactc aatggccgac tcttctagaa gctttagcca caagatcaga
2041 cgacacgcct cacctaaggc taaccacagt tgtcgtggcc aacaagtttg tcaacgatca
2101 aacggcgtcg catcggatga tgaaagagat cggaaaccga atggagaaat tcgctaggct
2161 tatgggagtt cctttcaaat ttaacattat tcatcacgtt ggagatttat ctgagtttga
2221 tctcaacgaa ctcgacgtta aaccagacga agtcttggcc attaactgcg taggcgcgat
2281 gcatgggatc gcttcacgtg gaagccctag agacgctgtg atatcgagtt tccgacggtt
2341 aagaccgagg attgtgacgg tcgtagaaga agaagctgat cttgtcggag aagaagaagg
2401 tggctttgat gatgagttct tgagagggtt tggagaatgt ttacgatggt ttagggtttg
2461 cttcgagtca tgggaagaga gttttccaag gacgagcaac gagaggttga tgctagagcg
2521 tgcagcggga cgtgcgatcg ttgatcttgt ggcttgtgag ccgtcggatt ccacggagag
2581 gcgagagaca gcgaggaagt ggtcgaggag gatgaggaat agtgggtttg gagcggtggg
2641 gtatagtgat gaggtggcgg atgatgtcag agctttgttg aggagatata aagaaggtgt
2701 ttggtcgatg gtacagtgtc ctgatgccgc cggaatattc ctttgttgga gagatcagcc
2761 ggtggtttgg gctagtgcgt ggcggccaac gtaaagggtt gtttttattt tttcataagg
2821 aattc
```

FIG. 9

MDTLFRLVSLQQQQQSDSIITNQSSLSRTSTTTTGSPQTAYHYN

FPQNDVVEECFNFFMDEEDLSSSSSHHNHHNHNNPNTYYSPFTTPTQYHPATSSTPSS

TAAAAALASPYSSSGHHNDPSAFSIPQTPPSFDFSANAKWADSVLLEAARAFSDKDTA

RAQQILWTLNELSSPYGDTEQKLASYFLQALFNRMTGSGERCYRTMVTAAATEKTCSF

ESTRKTVLKFQEVSPWATFGHVAANGAILEAVDGEAKIHIVDISSTFCTQWPTLLEAL

ATRSDDTPHLRLTTVVVANKFVNDQTASHRMMKEIGNRMEKFARLMGVPFKFNIIHHV

GDLSEFDLNELDVKPDEVLAINCVGAMHGIASRGSPRDAVISSFRRLRPRIVTVVEEE

ADLVGEEEGGFDDEFLRGFGECLRWFRVCFESWEESFPRTSNERLMLERAAGRAIVDL

VACEPSDSTERRETARKWSRRMRNSGFGAVGYSDEVADDVRALLRRYKEGVWSMVQCP

DAAGIFLCWRDQPVVWASAWRPT

FIG. 10

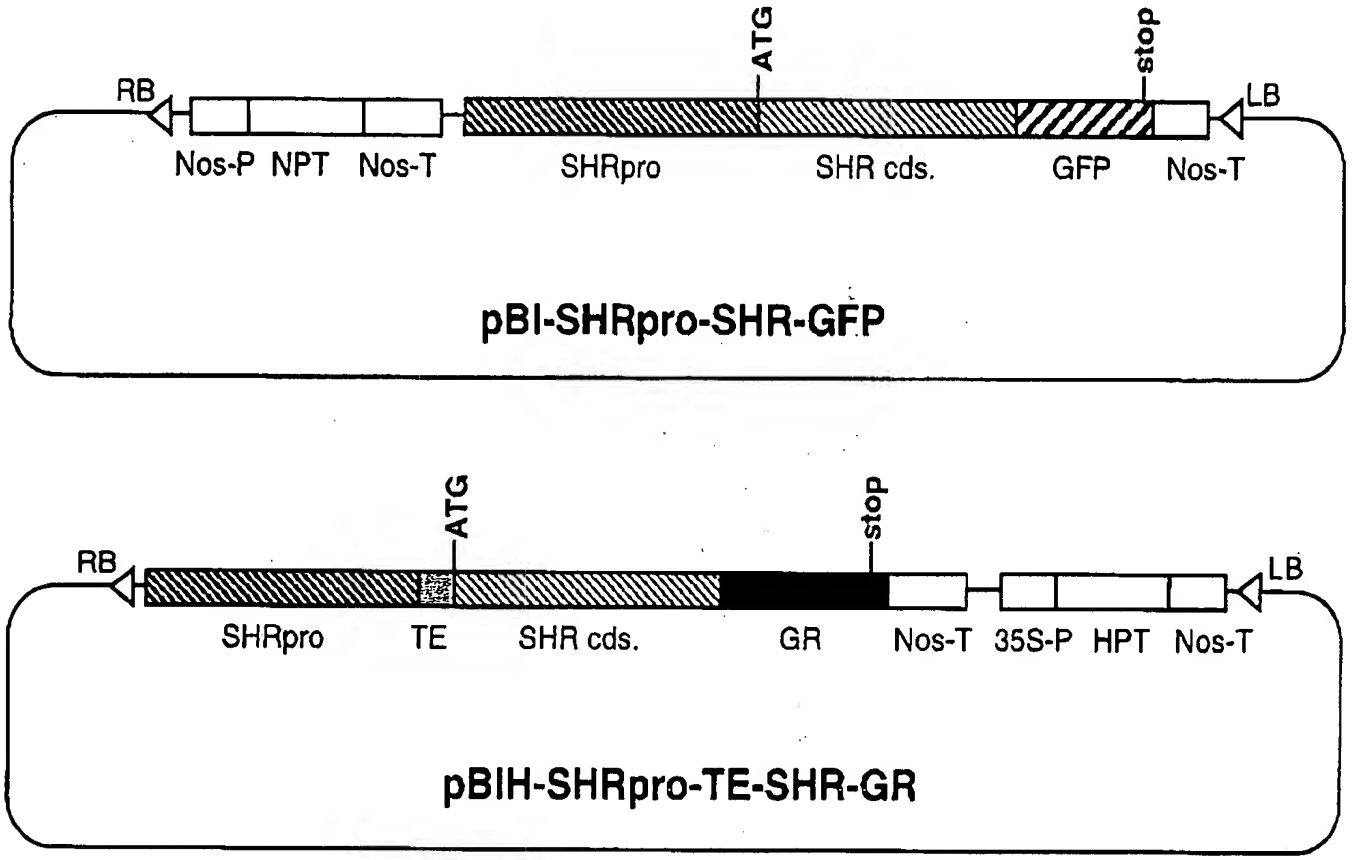
```
   1 aaaaaaaaaa aatggatact ctctttagac tagtcagtct ccaacaacaa caacaatccg
  61 atagtatcat tacaaatcaa tcttcgttaa gcagaacttc caccaccact actggctctc
 121 cacaaactgc ttatcactac aactttccac aaaacgacgt cgtcgaagaa tgcttcaact
 181 ttttcatgga tgaagaagac ctttcctctt cttcttctca ccacaaccat cacaaccaca
 241 acaatcctaa tacttactac tctcctttca ctactcccac ccaataccat cccgccacat
 301 catcaacccc ttcctccacc gccgcagccg cagctttagc ctcgccttac tcctcctccg
 361 gccaccataa tgacccttcc gcgttctcca tacctcaaac tcctccgtcc ttcgacttct
 421 cagccaatgc caagtgggca gactcggtcc ttcttgaagc ggcacgtgcc ttctccgaca
 481 aagacactgc acgtgcgcaa caaatcctat ggacgctcaa cgagctctct tctccgtaat
 541 gaaaaccgct tcattttcct tgtatttgtc tgaggttagg attagaccat tggttgttac
 601 tttcgaattc ttccaattta gttgttactt tcgaattctt ccatctctta gtttactaaa
 661 acaaacttat gtgccccata tttctccaac aatttgttga gtggtagctt acgttttact
 721 gtatacgctt ttgcaggtta tatcagcaca accattaatg atggcccggg atgtttgatg
 781 ctaagatgtc ctgacccatc ttgtcttgct gctgttggtc atgatatggt tgacaaatta
 841 gcgtctgaag acgaaaagga gaagtacaac agatattttc ttaggtctta tattgaagac
 901 aacagaaagg taagcagtct agaaaattta tatcacacag actggtatta atgtcgctgg
 961 tcttttattg agcaaaaact ggcttcttac ttcctccaag ctctcttcaa ccgcatgacc
1021 ggttcaggcg aacgatgcta ccgaaccatg gtaacagctg cagccacaga gaagacttgc
1081 tccttcgagt caacgcgaaa aactgtacta aagttccaag aagttagccc ctgggccacg
1141 tttggacacg tggcggcaaa cggagcaatc ttggaagcag tagacggaga ggcaaagatc
1201 cacatcgttg acataagctc cacgttttgc actcaatggc cgactcttct agaagcttta
1261 gccacaagat cagacgacac gcctcaccta aggctaacca cagttgtcgt ggccaacaag
1321 tttgtcaacg atcaaacggc gtcgcatcgg atgatgaaag agatcggaaa ccgaatggag
1381 aaattcgcta ggcttatggg agttcctttc aaatttaaca ttattcatca cgttggagat
1441 ttatctgagt ttgatctcaa cgaactcgac gttaaaccag acgaagtctt ggccattaac
1501 tgcgtaggcg cgatgcatgg gatcgcttca cgtggaagcc ctagagacgc tgtgatatcg
1561 agtttccgac ggttaagacc gaggattgtg acggtcgtag aagaagaagc tgatcttgtc
1621 ggagaagaag aaggtggctt tgatgatgag ttcttgagag ggtttggaga atgtttacga
1681 tggtttaggg tttgcttcga gtcatgggaa gagagttttc caaggacgag caacgagagg
1741 ttgatgctag agcgtgcagc gggacgtgcg atcgttgatc ttgtggcttg tgagccgtcg
1801 gattccacgg agaggcgaga gacagcgagg aagtggtcga ggaggatgag gaatagtggg
1861 tttggagcgg tggggtatag tgatgaggtg gcggatgatg tcagagcttt gttgaggaga
1921 tataaagaag gtgtttggtc gatggtacag tgtcctgatg ccgccggaat attcctttgt
1981 tggagagatc agccggtggt ttgggctagt gcgtggcggc caacgtaaag ggttgttttt
2041 atttttttcat aaggaattc
```

[redacted]-kb short-root promoter sequ[redacted]

10	20	30	40	50	
1234567890	1234567890	1234567890	1234567890	1234567890	
AGAAGCAGAG	CGTGGGGTTT	CTTCTAATAA	TTGTAGAAGA	AACTGATCAT	50
GAGAACATTT	GATCTACCAG	AGATGGTGAT	GACTCATAAG	ATGTAAATAT	100
CTACTGCATT	ATGTCTAGCC	TAGGCTATAA	TGTAGATTTG	ATCACTTTCT	150
TCATTAATTA	GTTTGGAATT	TTAGCATGAT	ATAGCATATA	TCTAAATATG	200
TCCGAAACTT	TCCTACATAC	TAGAAAATAT	GGAGAGTTAT	GTAATGTAGG	250
TTTGCTTGTT	AATATACAAA	ATAACATCAT	CATTTAGTTT	TTAGATTTTT	300
TATTTTATTT	TTTATAATGG	TGCTACGTAC	GTGGCGATCA	AATTATTCCA	350
ATTTTGAGAC	TTCGGGATTT	TAAACGAAAT	TAAACAATGG	GCATGAGCTC	400
GGGGGGATAG	ACAAGATTAA	TGCTTTGTAT	CGAGACAAAC	GAGAAAATCA	450
TGATGAGCCT	ATGCATTAAG	TGCCGTTGGT	TAATTAGAGG	TTCGCATATA	500
CATAAACCAG	TAGACATATG	GATAAATATG	AACACACACA	CCAAAAAAGT	550
GGGAAATCTA	AATAAGTGTA	GAGAATAATA	AGTCCTCAGG	TGGGAGATTC	600
AAAGAGAGGA	CAATGAAGGG	TATATAGACT	CTAAACAAAA	ATGGCATGAC	650
TTAGTGGAGA	GGGTTTTAAA	TTGAAACAAG	TAGGATTGAA	GAACAAGAAA	700
ACAAAGAAGC	ATGCCCTAGA	TTTCTGAGAT	AATAATTACA	CATTGCTGTT	750
TATATAAGGT	AAGAGAATAT	GACACATTGG	TTGGTTTCTT	ACGGGTAAAT	800
GTGAAGAAAA	AAAAATAGTA	ATATTTGAGA	AAATCTAAAA	TAGTAAAGAG	850
GTATATATGG	AGAAGAAGAG	AGAAAAGGGA	AAAATAGTGG	CAGAGAATGG	900
AGAGAGGTTA	GGAGGCAAAG	GCAAATGTGG	AGCTTTGATG	ATGTTGATGC	950
ACGCCGTCAG	CTTTTCTTCA	CGCCTGCTCC	CACTCACTCA	CACCTATGAA	1000
CATTCTCTCT	CTATTTTATA	ATTATATTCA	CATGTCTCTA	TGTTACTATG	1050
TAAATGGTGA	CCACTTAAGT	ATTTATATAT	CATGTATATA	TCTTATAGGT	1100
ATCATACAAA	ATGGTCATGA	AACTTTTGCA	ATTTCAATCT	ACTTGTTCAT	1150
TGTAGATGCT	AGCTTTTCAC	ATGTTTTGAA	AATTAGTCTG	GATCTGAAAT	1200
TCTTTAATTA	GCATTGTTTT	GTTGGTCAAC	GTTTAATTTC	TTGATTATTG	1250
ATGTCAAAAA	TTCAGAGCGT	TCAGAACTCT	TACACTAATT	TCTTAAAAAT	1300
AATCGATTAA	GAGAAAATAG	AGTTTTCATG	CACCAGTGTT	GATAGTAACG	1350
TAGTCGCGGA	ATGTCTAAAA	CGATTATGAG	TTTGGTGTTT	TGATTGGTTA	1400
GAATTGGTAT	TAGTAGGACA	TTCTAACTTT	TTTGTTAGTC	TGTTGATTTA	1450
GGATGCGTAA	AGAGTCTTTT	TATTTTACAC	CAGTTGAGAC	TTGGGATCGA	1500
TAGTACTTGA	AACACTTGGT	TGGTTTCATG	TATTTGGCCT	ATATATAAAC	1550
AAACATCGTA	ATTATATACG	GATTTTTTTC	GGAATTTTAC	GCCATATCTG	1600
TAAGTATATA	TAACATGCAT	GTCGTTTTCA	AATTCATATG	ATGAACGATC	1650
CACGTAAGTG	CTACTACTCC	TACAATATTG	CATGAGAGAG	ATATGTATTT	1700
ATAAATTTTA	TTTTGAAGAA	GAAATAAGAG	GGAAGGTTAC	TTGGGTGGAT	1750
CGATGTGAAA	ACAAAAGAAG	AAAAAGCGAA	ACCCACTAAG	CCATTACATG	1800
ATATCGACCT	TCTTATCTTT	TTCCTCTTTA	TTTTATTTTT	CTCAGGACTT	1850
TTTTCTACTT	AATGAAACCT	CCAAACTATC	TAACTAATAC	ACTCCCATGT	1900
AGAATAAAGA	AAATTATATA	AGATATTGTT	GATATTTTGT	AACTAGAAAA	1950
TATATTTGCT	CTGTAATTTT	TCGTAAGTTA	AATCAACATT	TTTCAGTAGA	2000
AACAAATATT	ACTGCAAAAA	GTAGGATCAT	TATTTTTGTC	CAAAATCTCA	2050
GTTAGCTATA	GGGTTGTAGT	AAAAACAAAA	CACATTCTTG	ATTTGCCCCA	2100
AAAAATAAAG	AGAGAGAAGA	ATATTGTTCA	AAAGTGGTCT	CTTCTCTCTC	2150
TAATTATGTT	TTCACTAAAC	CCAATTAGAT	TCAAACAGTC	TACAAAGTCC	2200
AAAAGATAAA	CATGGGACAA	CAATTCGATG	CAAAAAATCC	TCTTTTCATG	2250
CTCTTTTTTT	ATTCTCTAGT	CTTTTAAATT	ACTAATAAAA	ACTCACAAAT	2300
CCACCAAACC	CATTCTCTAC	AACTCACCTT	CATCTAGATT	TACCCACTCC	2350
CACCGAGAAA	CACAAGAAAA	AAAATATACA	TATATAAATA	TACAAGACAA	2400
CACATGATGC	TGATGCAATA	TACACAACAA	AGTATTAAAT	CTTAGATATT	2450
GTGGGTCTCC	CTTTCTTCTA	TTCATTTTCT	TATTCATTAA	AAAAAAAAAA	2500
TG					2502

FIG. 11

FIG. 12A



RB, right border sequence from *Agrobacterium* Ti plasmid
SHRpro, 2.5-Kb 5' upstream region of *SHORT-ROOT* gene
TE, translational enhancer element of tobacco etch virus
SHR cds., *SHORT-ROOT* protein coding region
GR, rat glucocorticoid receptor domain coding sequence
GFP, green fluorescent protein coding sequence
Nos-T, transcriprion terminator of nopaline synthetase gene
35S-P, cauliflower mosaic virus 35S promoter
HPT, hygromycin phosphotransferase coding sequence
NPT, neomycin phosphotransferase coding sequence
LB, left border sequence from *Agrobacterium* Ti plasmid

0957827 .052408

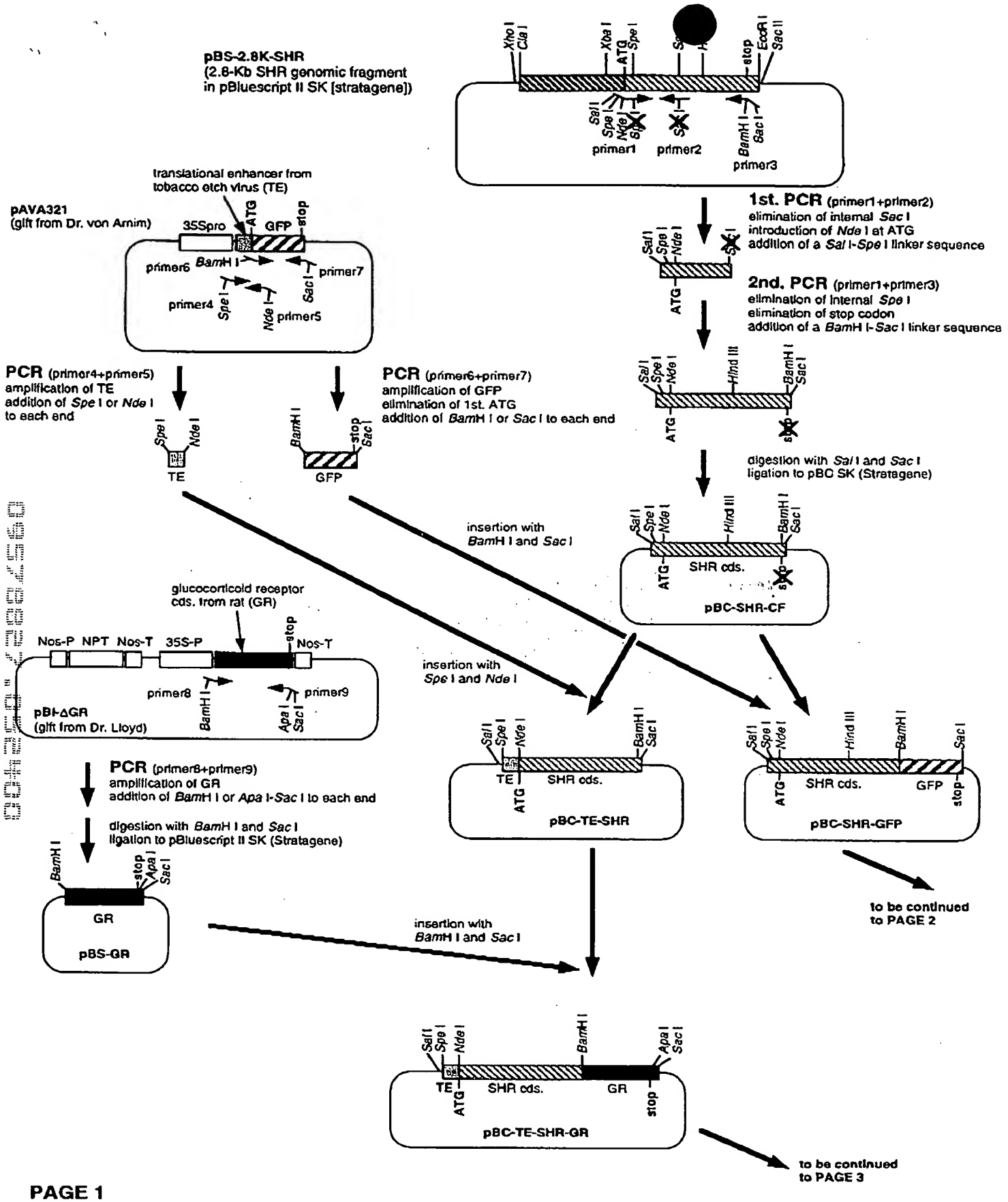
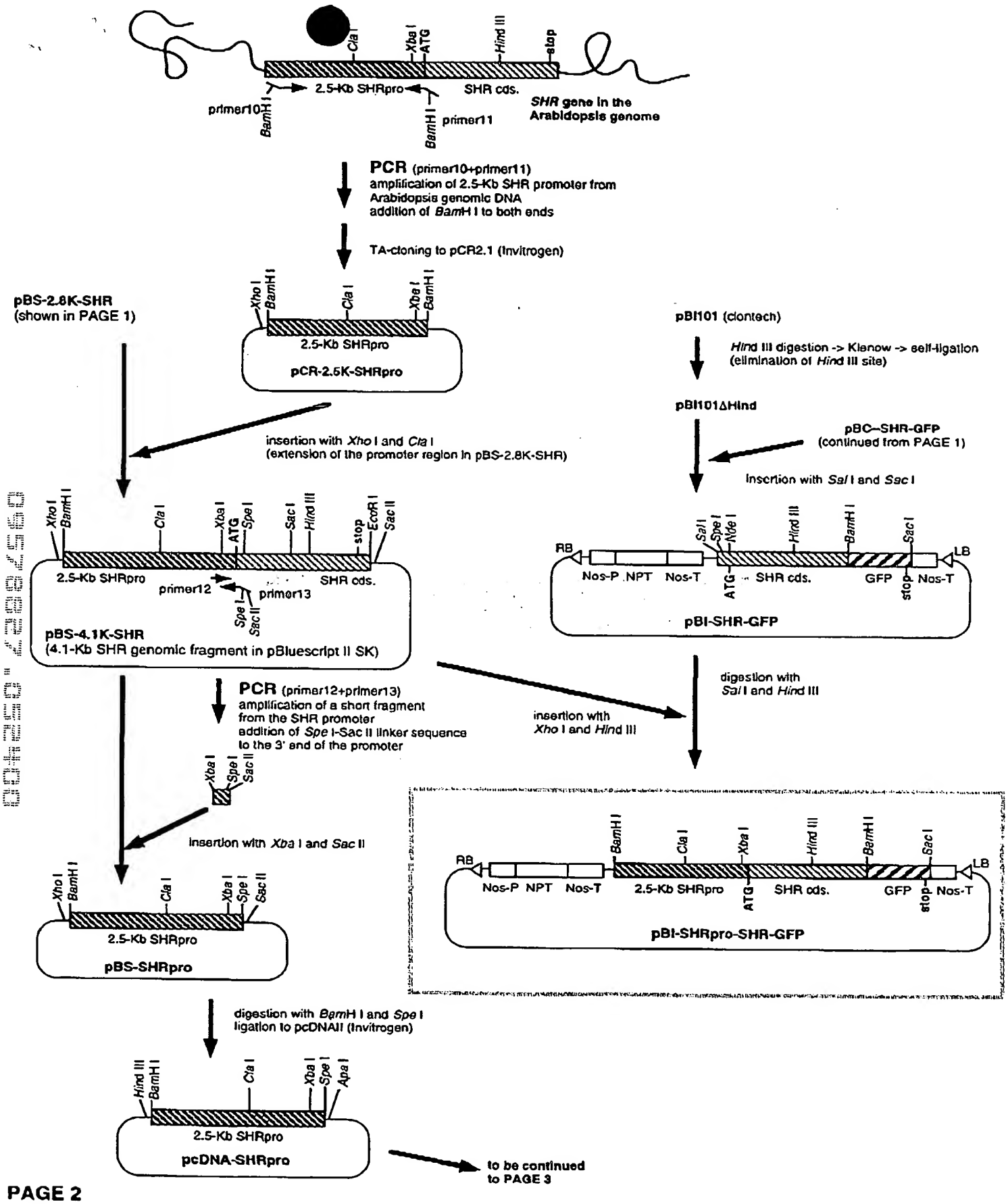
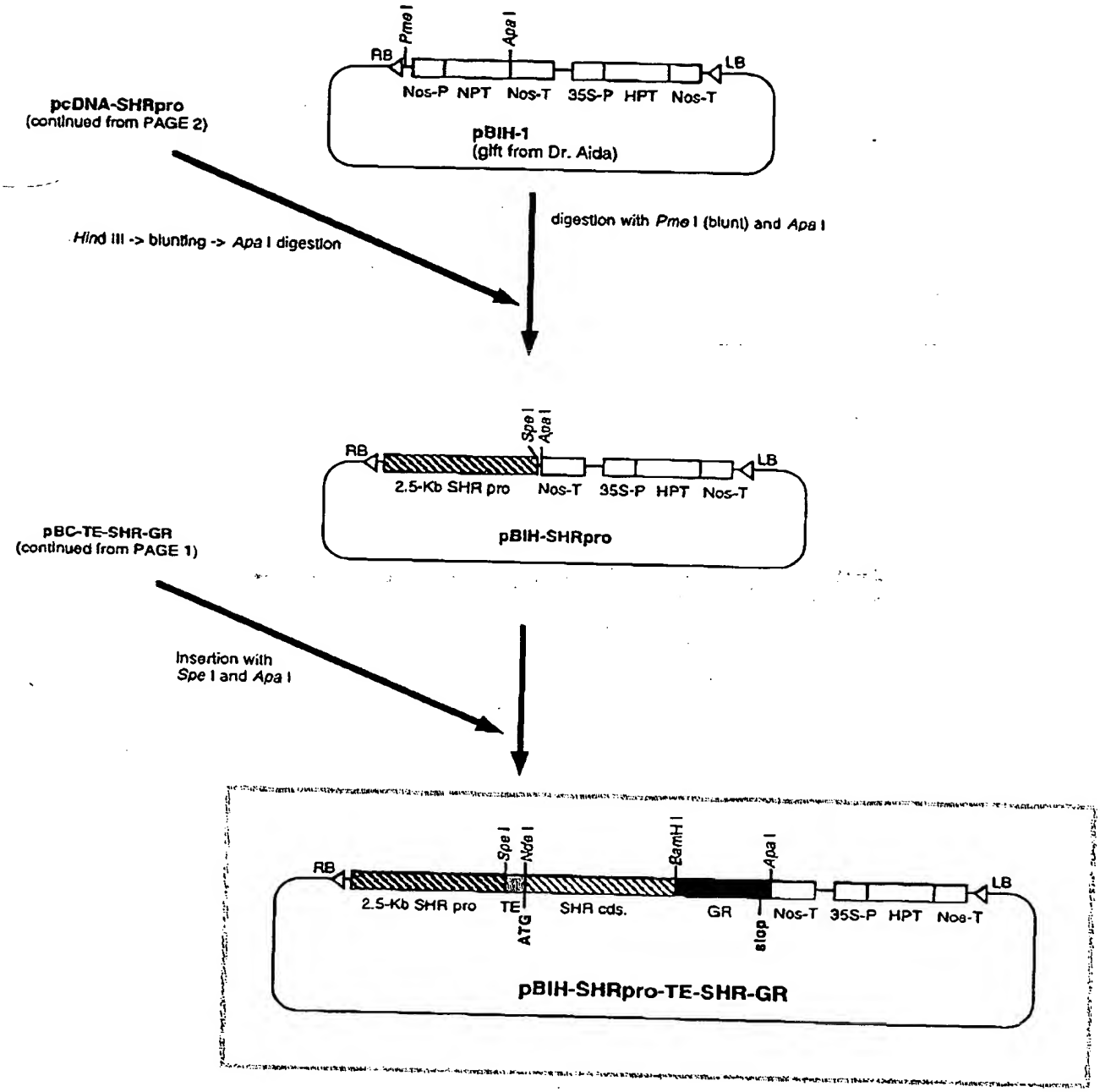

pBS-2.8K-SHR
(2.8-Kb SHR genomic fragment
in pBluescript II SK [stratagene])
primer1
primer2
primer3
translational enhancer from
tobacco etch virus (TE)
pAVA321
(gift from Dr. von Arnim)
35Spro
ATG
GFP
stop
primer6
primer7
primer4
primer5
1st. PCR (primer1+primer2)
elimination of internal Sac I
introduction of Nde I at ATG
addition of a Sal I-Spe I linker sequence
2nd. PCR (primer1+primer3)
elimination of internal Spe I
elimination of stop codon
addition of a BamH I-Sac I linker sequence
PCR (primer4+primer5)
amplification of TE
addition of Spe I or Nde I
to each end
PCR (primer6+primer7)
amplification of GFP
elimination of 1st. ATG
addition of BamH I or Sac I to each end
TE
GFP
digestion with Sal I and Sac I
ligation to pBC SK (Stratagene)
insertion with
BamH I and Sac I
SHR cds.
pBC-SHR-CF
glucocorticoid receptor
cds. from rat (GR)
Nos-P NPT Nos-T 35S-P Nos-T
primer8
primer9
pBI-ΔGR
(gift from Dr. Lloyd)
insertion with
Spe I and Nde I
PCR (primer8+primer9)
amplification of GR
addition of BamH I or Apa I-Sac I to each end
digestion with BamH I and Sac I
ligation to pBluescript II SK (Stratagene)
pBC-TE-SHR
pBC-SHR-GFP
GR
pBS-GR
insertion with
BamH I and Sac I
to be continued
to PAGE 2
pBC-TE-SHR-GR
to be continued
to PAGE 3
PAGE 1

FIG. 12B



PAGE 2

FIG. 12C



PAGE 3

FIG. 12D

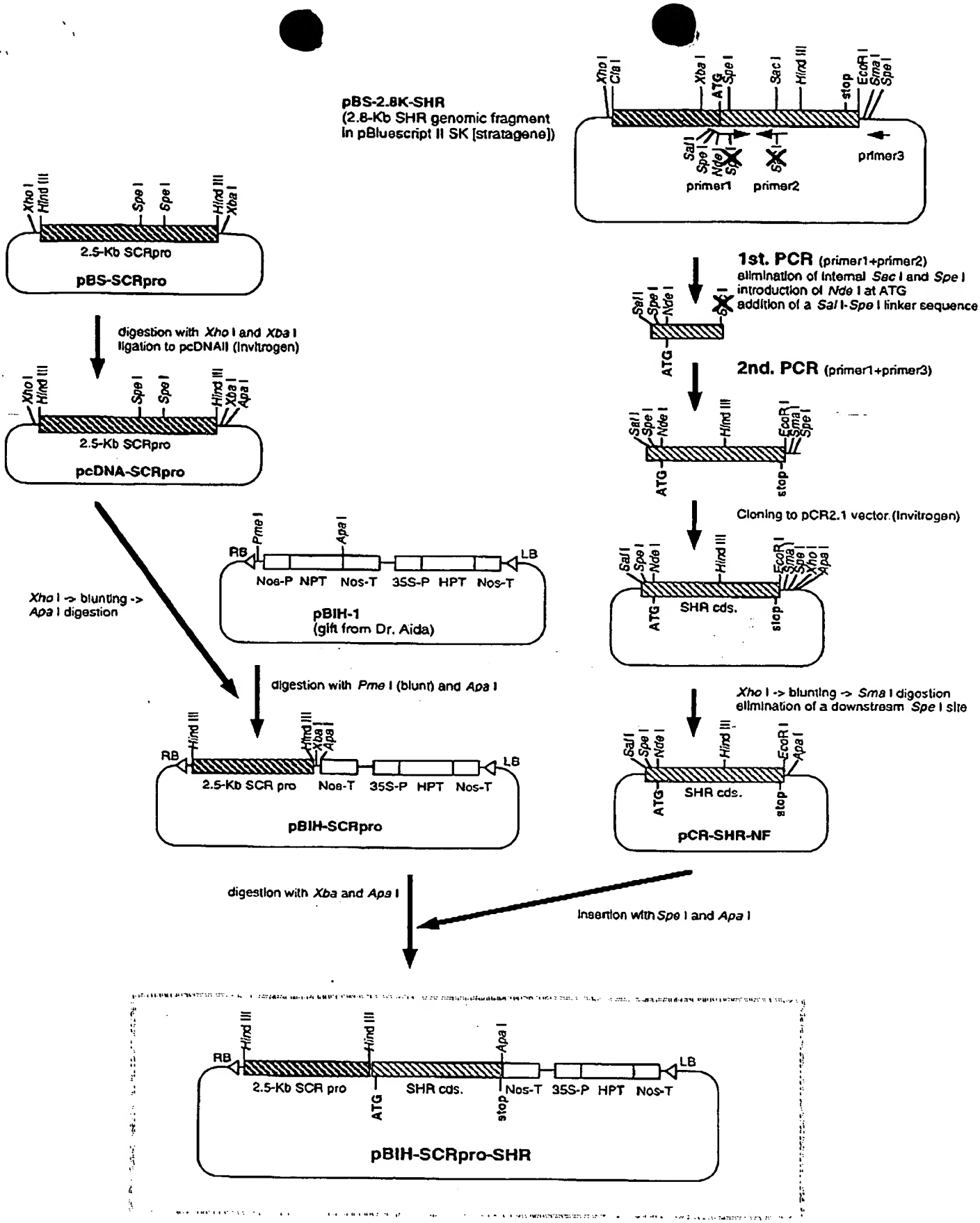

pBS-2.8K-SHR
(2.8-Kb SHR genomic fragment
in pBluescript II SK [stratagene])
primer1
primer2
primer3
1st. PCR (primer1+primer2)
elimination of internal Sac I and Spe I
introduction of Nde I at ATG
addition of a Sal I-Spe I linker sequence
2nd. PCR (primer1+primer3)
Cloning to pCR2.1 vector (Invitrogen)
2.5-Kb SCRpro
pBS-SCRpro
digestion with Xho I and Xba I
ligation to pcDNAII (Invitrogen)
pcDNA-SCRpro
Xho I -> blunting ->
Apa I digestion
pBIH-1
(gift from Dr. Aida)
digestion with Pme I (blunt) and Apa I
pBIH-SCRpro
SHR cds.
pCR-SHR-NF
Xho I -> blunting -> Sma I digestion
elimination of a downstream Spe I site
digestion with Xba and Apa I
insertion with Spe I and Apa I
pBIH-SCRpro-SHR

FIG. 13

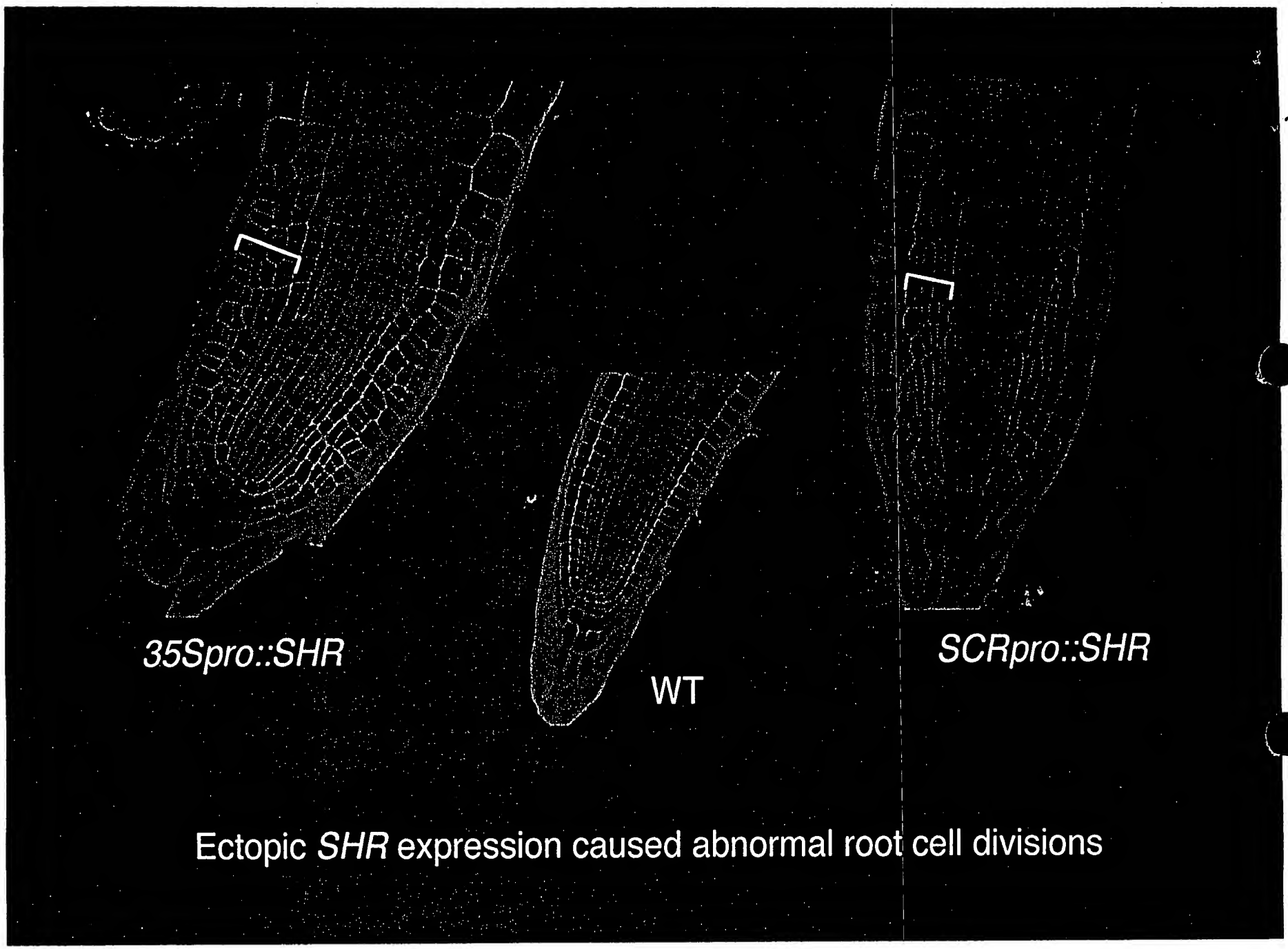
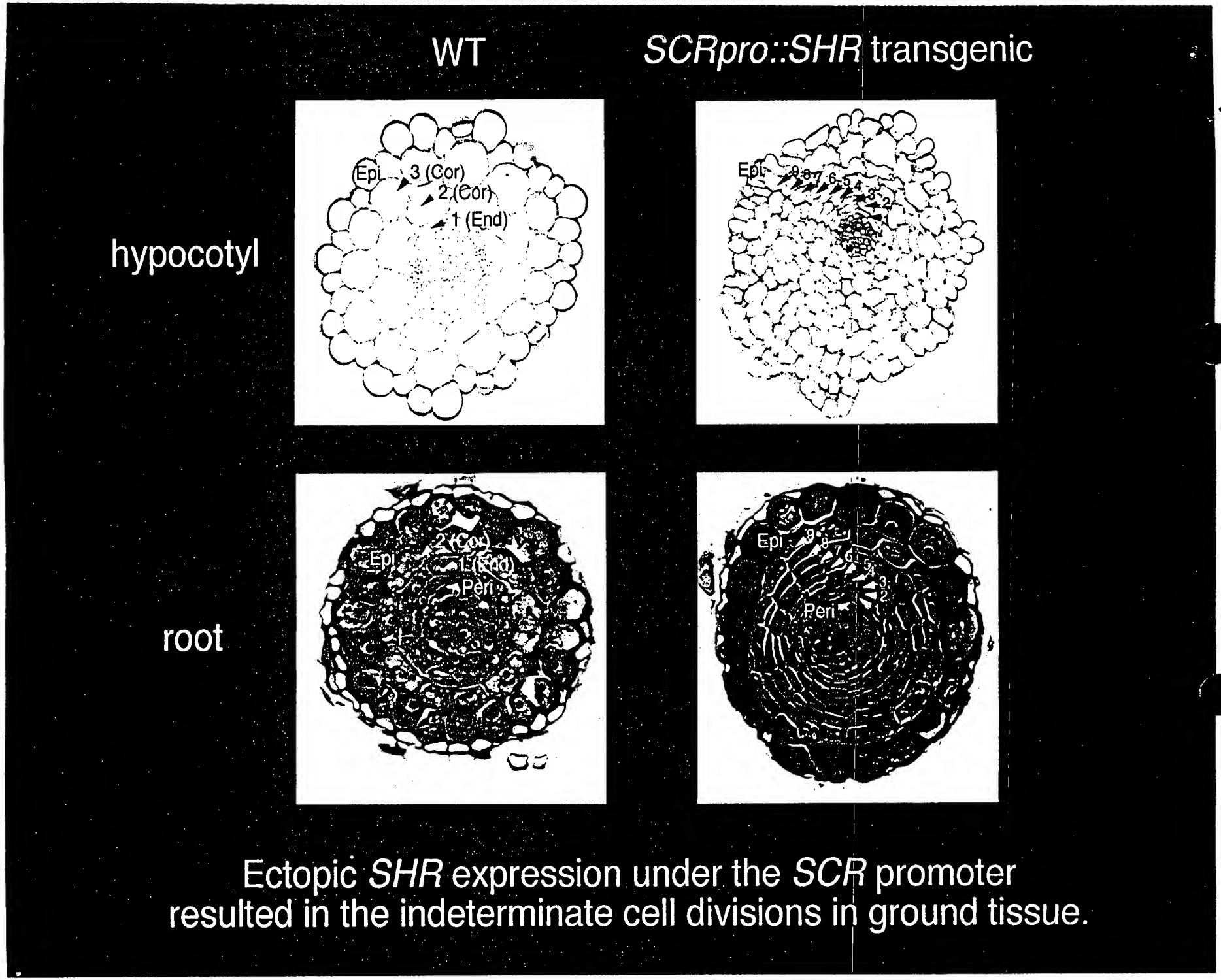

35Spro::SHR
WT
SCRpro::SHR
Ectopic SHR expression caused abnormal root cell divisions

FIG. 14



Ectopic *SHR* expression under the *SCR* promoter resulted in the indeterminate cell divisions in ground tissue.

FIG. 15

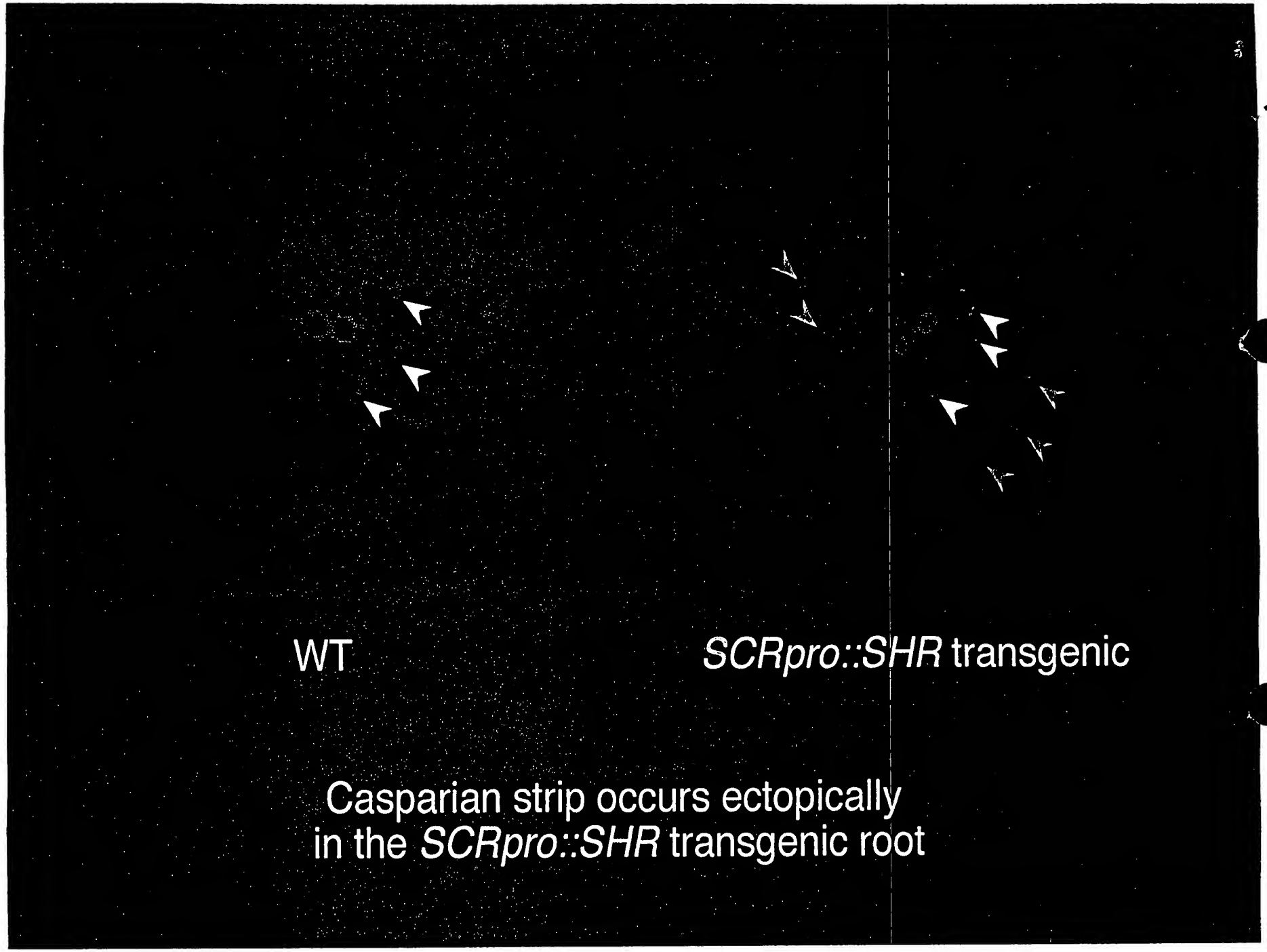

WT
SCRpro::SHR transgenic
Casparian strip occurs ectopically
in the SCRpro::SHR transgenic root

FIG. 16